EQUIPMENT CERTIFICATE

Certificate No.:	Issued:	Valid until:	GCC class
TC-GCC-DNVGL-SE-0124-07792-0	2021-10-14	Unlimited	TC_I

Issued for:

PV Inverters SDT G2: GW4K-DT TO GW25KT-DT (PPM Type A)

With specifications and software version as listed in Annex 2

Issued to:

JIANGSU GOODWE POWER SUPPLY TECHNOLOGY CO., LTD.

No.90 Zijin Rd., New District, Suzhou, 215011, China

According to:

DNVGL-SE-0124, 2016-03: Certification of Grid Code Compliance

PTPiREE, 2021-04: Conditions and procedures for using certificates in the process of connecting power generating modules to power networks

32016R0631, 2016-04: Requirements for Generators (NC RfG)

PSE, 2018-12: Requirements of general application resulting from Commission Regulation (EU) 2016/631 of 14 April 2016

detailed in Annex 1

Based on the document:

CR-GCC-DNVGL-SE-0124-07792-A072-0 Network Code Requirements for a PGU of Type A - Poland, Certification Report, dated 2021-10-14

Further assessment information, including scope and conditions, is found in Annex 1. Description of the PV inverters and type tests performed is found in Annex 2 and Annex 3 respectively.

Hamburg, 2021-10-14

For DNV Renewables Certification

Bente Vestergaard
Director and Service Line Leader Type and Component Certification

DAkkS Deutsche Akkreditierungsstelle D-ZE-11053-01-00

By DAkkS according DIN EN IEC/ISO 17065 accredited Certification Body for products. The accreditation is valid for the fields of certification listed in the certificate.

Hamburg, 2021-10-14

For DNV Renewables Certification

i.A. L Ulvgård

Liselotte Ulvgård
Project Manager

EQUIPMENT CERTIFICATE – ANNEX 1

Conditions, assessment criteria and scope of assessment

Provided that the conditions listed in section 1 are considered at project level, the PV inverters as further specified in Annex 2 comply with the requirements within scope of this certification, as specified in section 3.

1 **Conditions**

- Changes of the system design, hardware or the software of the certified PV inverters are to be approved by DNV.
- Inverter settings must finally be agreed and checked at project level to ensure grid code compliance, based on the requirements of relevant System Operator (SO). For the functionalities within scope of this certification, more information about the settings assessed is found in Control Settings in section 4.2 as well as the corresponding assessment sections 5.1-5.4 of the certification report CR-GCC-DNVGL-SE-0124-07792-A072-0.

2 **Assessment criteria and normative references for this certificate:**

/A/ Service Specification DNVGL-SE-0124: Certification of Grid Code Compliance, DNV GL, March 2016

/B/ Conditions and procedures for using certificates in the process of connecting power generating modules to power networks, Warunki i procedury wykorzystania certyfikatów w procesie przyłączenia modułów wytwarzania energii do sieci elektroenergetycznych, version 1.2, PTPiREE, dated 2021-04-28, (in the following: PTPiREE 2021-04)

/C/ Requirements of general application resulting from Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (NC RfG) – as approved by the decision of the President of the Energy Regulatory Office DRE.WOSE.7128.550.2.2018.ZJ dated January 2nd 2019, Wymogi ogólnego stosowania wynikające z Rozporządzenia Komisji (UE) 2016/631 z dnia 14 kwietnia 2016 r. ustanawiającego kodeks sieci dotyczący wymogów w zakresie przyłączenia jednostek wytwórczych do sieci (NC RfG), PSE S.A., dated 2018-12-18 zatwierdzone Decyzją Prezesa Urzędu Regulacji Energetyki DRE.WOSE.7128.550.2.2018.ZJ z dnia 2 stycznia 2019 r, (in the following: PSE 2018-12)

/D/ Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators, published in the Official Journal of the European Union L112/1, The European Comission, 27/04/2016. Document 32016R0631, (in the following: NC RfG)

3 Scope of assessment and results

The following functionalities have been assessed based on the rules for the use of equipment certificates for Power Park Modules (PPMs), as specified in chapter 7 and 9 of the PTPiREE 2021-04 /B/. The functions denoted “Not Applicable” in the table of chapter 7 has not been included.

Capability	NC RfG /D/	PSE 2018-12 /C/	Type A	Assessment result (*)
Frequency range	13.1 (a)	13.1 (a)(i)	x	Compliant
Rate of Change of Frequency (RoCoF) withstand capability, df/dt	13.1 (b)	13.1 (b)	x	Compliant
Remote cessation of active power	13.6	13.6	x	Compliant
Limited Frequency Sensitive Mode – Over Frequency (LFSM-O)	13.2	13.2 (a), (b), (f)	x	Compliant

(*) Please note also the corresponding conditions for compliance, as stated in section 1

EQUIPMENT CERTIFICATE – ANNEX 2

Schematic description and technical data of the generating units

1 Schematic description of the generating unit

The GoodWe solar inverter family SDT G2: GW4K-DT TO GW25KT-DT, consisting of: GW4K-DT, GW5K-DT, GW6K-DT, GW8K-DT, GW10KT-DT, GW12KT-DT, GW15KT-DT, GW17KT-DT, GW20KT-DT, GW25KT-DT convert electrical energy generated by photovoltaic modules (DC) to three phase alternating current (AC).

They run at 400 V rated output voltage with a rated active power output of 4 kW to 25 kW. The different output power variants are achieved through derating via the rating resistance position. Due to different power levels, reactors, capacitors and current sensors have different ratings. Also, some models are equipped with internal or external fan, or both. There is no further difference in the hardware or firmware used. It has been concluded that the presented differences do not impact the electrical behavior in scope of the certification.

The electrical data of the generating unit is summarized in the following section.

2 Technical data of main components

According to the documents provided by the manufacturer, the following components are used.

2.1 General Specifications

Generating Unit	GW4K-DT	GW5K-DT	GW6K-DT	GW8K-DT	GW10KT-DT
No. of phases	3	3	3	3	3
Max apparent power	4400VA	5500VA	6600VA	8800VA	11000VA
Rated active power	4000W	5000W	6000W	8000W	10000W
Rated AC-voltage	400 Vac	400 Vac	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz
Generating Unit	**GW12KT-DT**	**GW15KT-DT**	**GW17KT-DT**	**GW20KT-DT**	**GW25KT-DT**
No. of phases	3	3	3	3	3
Max apparent power	14000VA	16500VA	19000VA	22000VA	27500VA
Rated active power	12000W	15000W	17000W	20000W	25000W
Rated AC-voltage	400 Vac	400 Vac	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz

2.2 DC Input

Generating Unit	**GW4K-DT, GW5K-DT, GW6K-DT, GW8K-DT, GW10KT-DT**	**GW12KT-DT, GW15KT-DT**	**GW17KT-DT, GW20KT-DT**	**GW25KT-DT**
Min. MPPT voltage	180 Vac	180 Vac	180 Vac	180 Vac
Max. MPPT voltage	850 Vac	850 Vac	850 Vac	850 Vac
Max. DC input voltage	1000 Vac	1000 Vac	1000 Vac	1000 Vac
Max. DC input current	12.5/12.5 A	12.5/25 A	25/25 A	37.5/25 A

2.3 Software Version

Software version	Firmware: 290-10203
	Software: V1.12.12

2.4 Unit transformer

The transformer is not part of the generating unit and consequently has not been part of the assessment.

2.6 Grid Protection

The protection is not part of certification scope

2.7 Control settings

The control interface allows for the selection of different parameter sets via the “Safety Option” field, which provide default settings based on specific grid codes and national requirements. For this certification report the parameter set called “Poland” in the interface, was assessed for the functionalities within scope of this certification.

It should be noted that compliance can be achieved also with other parameter sets and control settings, but that changes to control settings will affect the inverter control behaviour which can thus affect compliance. It should be noted the final settings must be agreed on project level in agreement with relevant system operator.

Protection settings has not been part of the assessment. Since these could intervene with and affect the compliance of the assessed functionalities, this must be further assessed at project level.

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EQUIPMENT CERTIFICATE – ANNEX 3

Type tests

1 Type tests

Tests were performed between 2021-04-14 and 2021-04-16 in the GoodWe lab, Suzhou (P.R. China). Due to a software update, made to improve the initial response time for LFSM-O as further described in section 5.5 of the certification report CR-GCC-DNVGL-SE-0124-07792-A072-0, complementary LFSM-O tests were also assessed, provided separately by the test lab. In addition, test report /2/ performed according to EN 50549-1:2019 was taken into consideration for remote cessation of active power. All tests were performed under ISO-17025 accreditation and they were performed on the GW12KT-DT unit.

The results used for assessment are documented in the measurement report(s) as specified below:

Scope	Reference
Frequency range	3.1.1 and 3.1.2 of /1/
Rate of Change of Frequency (RoCoF) withstand capability, df/dt	3.2 of /1/
Remote cessation of active power	3.3 of /1/ and 1.4.12 of /2/
Limited Frequency Sensitive Mode – over frequency (LFSM-O)	3.4 of /1/

Test report(s)	Document number	Content
/1/	*10289930-A-1-A*	Measurement of power control characteristics of a PV inverter of the type GW12KT-DT according to FGW TG3 Rev. 25 and Polish Grid Code - with complementary test report: “goodwe update-LFSM-O_12K_136K_20210929.pdf” provided by test lab
/2/	50376759001	Test report, EN 50549-1:2019, Requirements for generating plants to be connected in parallel with distribution networks – Part 1-1: Connection to a LV distribution network – Generating plants up to and including type B

The tests results have been assessed against the requirements of PSE 2018-12 /C/ and NC RfG /D/. Further details are described in the corresponding certification report CR-GCC-DNVGL-SE-0124-07792-A072-0.

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